“Powering Down”
Realising Energy and Greenhouse Gas reductions in buildings, facilities and street lights

Final Report
Brimbank City Council

This activity received funding from the Australian Government
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1. Executive Summary

The ‘Powering Down’ Project, co-funded by the Australian Government, is the single largest undertaking of energy efficiency activities in the history of Brimbank City Council.

The key purpose of the Project was to improve energy efficiency, reduce energy use and greenhouse gas emissions of key Council buildings, facilities and street lights.

Council received $3,512,866 in Round 1 of funding and contributed $3,518,997 to this Project (with an additional over-spend of Council expenditure of $6,131).

The total Project Expenditure of $7,031,863 enabled the following Activities to be completed across 2012 - 2016:

- Changeover of over 11,622 Public Street Lights to Energy Efficiency Lights
- Heating, Ventilation and Air Conditioning (HVAC) upgrade at Sunshine Municipal Offices
- Lighting and Insulation Retrofit at Keilor Municipal Offices
- HVAC Upgrade at Deer Park Library
- Cogeneration Installation at Sunshine Leisure Centre

Across the office and Library upgrades, Council successfully managed to keep sites operational with minimal disruption to services. With the installation of a Cogeneration plant at Sunshine Leisure Centre, Council carefully planned the project to ensure that adopting a new technology within our facilities was a smooth and well-prepared process, through commissioning to ongoing maintenance.

The most ambitious activity within this Project was public streetlight upgrades across two Distribution Network Service providers (Jemena and Powercor), spanning the entire four-year project period. Early public streetlight data collation and installation problems were worked through and, by Stage 3 of the public lighting changeover, there were no major issues.

The Powering Down Project has delivered a range of significant benefits to Council. Stakeholder relationships have been built and maintained, especially with our Distribution Network Service Providers, Powercor and Jemena. Key communication channels have been redefined within Council, with effective cross-departmental collaboration recognised as a key factor in the successful delivery of this Project. Council also provided project updates and delivered community energy reduction education throughout the funding period.

The combined annual greenhouse gas savings are estimated at a total of 4,296.2 tonnes CO$_2$e annual reduction. This represents a reduction of approximately 13,019,809.7 MJ, and an estimated 16% of Council’s overall operational greenhouse emissions (on 2011 levels). The Project contributes around a third of Council’s 50% greenhouse emissions reduction target for the year 2022/23.

Council is proud to have worked with our project stakeholders and the Australian Commonwealth Government to complete this Project on time and within budget.
Demonstrating energy reduction and improving energy management practices across Council buildings, community facilities and public lighting has aligned this Project with the funding objectives. Significant cost savings are being redirected back into Council’s services and further energy efficiency initiatives.

For more information about details contained in this report please contact the Brimbank City Council Environment Department 03) 9249-4920 environment@brimbank.vic.gov.au

The views expressed herein are not necessarily the views of the Commonwealth of Australia, and the Commonwealth does not accept responsibility for any information or advice contained herein.
"This Project is the single largest energy and greenhouse gas reduction undertaking in the history of Brimbank City Council. Together with Council’s contribution, this funding has enabled Council to achieve significant energy efficiency outcomes, contributing to our greenhouse gas reduction target of a 50% reduction on 2011 levels by 2022/23.

The cost savings from reduced energy consumption will benefit our community for many years to come”

Paul Younis, CEO Brimbank City Council
2. What did we aim to achieve?

**Council’s Project Objectives**

The key objectives of the ‘Powering Down’ Project were to:

- Significantly improve the energy efficiency of key buildings, facilities and Street Lights; Public Street Lighting, Sunshine Municipal Offices, Keilor Municipal Offices, Deer Park Library and Sunshine Leisure Centre.

- Reduce the greenhouse gas emissions from electricity and gas operational use,

- Improve the management of the buildings and facilities and service to the community through reduced running costs and increase occupant comfort,

- Demonstrate Council’s commitment to reducing our operational energy and greenhouse gas emissions, and

- Contribute to the achievement of key Brimbank Greenhouse Reduction Strategy 2013-23 targets

Council’s Project Objectives were directly aligned with the funding objectives by addressing and demonstrating energy reduction and management practices across Council buildings, community facilities and public lighting.

3. What we achieved, what we learnt, and how we got there

3.1. Buildings, facilities and street lighting Activities

Council’s ‘Powering Down’ Project involved 5 separate Activities:

- Changeover of over 11,622 Public Street Lights to Energy Efficiency Lights

- Heating, Ventilation and Air Conditioning (HVAC) upgrade at Sunshine Municipal Offices

- Lighting and Insulation Retrofit at Keilor Municipal Offices

- HVAC Upgrade at Deer Park Library

- Cogeneration Installation at Sunshine Leisure Centre

The approach, outcomes and lessons learnt for each Activity are outlined in the following sections.
3.1.1. Public Street Lighting – Installation of Energy Efficient Lights

Our Challenge

This Activity was the largest in the Project, involving the replacement of 11,622 old and inefficient mercury vapour (MV) lamps to modern energy efficiency LED, T5 and CFL lights. These lights included Category P (residential) streets and parks/recreational areas throughout the entire Brimbank municipality.

This Activity aimed to significantly reduce electricity use and costs, and the associated greenhouse gas emissions from the operational use of these lights. This Activity demonstrated energy reduction action to our entire Brimbank community.

Our Approach

Council planned to replace these lights over 3 distinct stages. Engaging the Municipal Association of Victoria (MAV) in association with Ironbark Sustainability, Council was supported with technical and project management expertise throughout the entire Activity period.

At the time of applying for Round 1 funding, T5 or compact fluorescent (CFL) lights were the only two energy efficient replacement options approved by Council’s Distribution Network Service Providers (DNSPs), Powercor and Jemena.

The original plan was therefore based on installing T5 lights. These lights provided a distinct improvement on MV lamps in terms of energy efficiency, light output and light colour.

The Stage One installation area included the southern region of Brimbank’s municipality. This included the entire Jemena network in Brimbank, and approximately a third of the Powercor lights near the Jemena boundary. Both these DNSP areas were changed over simultaneously in Stage One.

Stage Two was the middle section of the municipality, and Stage Three the northern area. Both these stages covered lights entirely within the Powercor service area.

Following the completion of Stage One, Powercor approved an LED street light for use on their network. The capital cost of purchasing the LED lights was higher than the T5s, but the overall cost savings and environmental benefits are superior. Council decided, in conjunction with the Department, to purchase and install LEDs for the remaining two stages.

Council purchased the lighting hardware from an MAV Panel of Providers, and delivered the lights to the DNSP-contracted installer.

Council provided internal and external communications for each stage and handled resident enquiries directly, with technical support from Ironbark Consulting. The old MV lights were dismantled and recycled by the DNSP’s contractors.

Each stage utilised a Project Control Group (PCG)
with representatives from the DNSP, their contracted installer, Ironbark Sustainability and Council. The PCG met regularly throughout the project to ensure issues were rectified, and data on street light numbers was recorded and updated each week.

A Brimbank PCG was also formed from the beginning of the Activity. This internal PCG included staff from Environment, Engineering Services, Urban Design and Building Maintenance Departments to assist in decision-making on the design and installation of lights in specific areas of the municipality. This important stakeholder group ensured the Activity complemented other street light/road works, urban design projects and strategic town centre plans.

At the end of each stage, all light numbers and DNSP data was reviewed to inform the next stage of works. Changes in approach and project management were also applied to the next stage to ensure each future stage was run more efficiently.

**Works Completed**

Across the three stages, 11,622 old and inefficient mercury vapour (MV) lamps were changed to energy efficiency LED, T5 or CFL lights:

- 7,301 x 80 Watt (W) and 125 W Mercury Vapour (MV) lights were replaced by LEDs.
- 4,282 x 80 W and 125 W MV lights were replaced by T5s.
- 39 x 80 W MV lights were replaced by 42 W CFLs.

The installation of these lights throughout the entire Brimbank municipality, has also achieved a greater uniformity of light in our residential streets, better colour consistency and visibility.

**Outcomes and Benefits**

Each light changed to LED represents a 77% reduction in electricity use, and each light changed to a T5 represents a 68% reduction. Council has begun and will continue to receive savings on electricity bills from these new lights, enabling other community projects to benefit from this Activity.

Approximately $10 million in energy and maintenance savings over the 20-year life of the new lights has been projected by Council’s consultant Ironbark Sustainability.

In addition to offering lower costs, lower energy consumption and lower greenhouse gas emissions, the new lights provide better lighting outcomes for the community. These outcomes include greater uniformity of light across and along Brimbank’s streets, better colour consistency and less depreciation of the light output over time.

**Energy Efficiency Outcomes**

Council’s consultants have calculated an expected reduction in energy use by over 3.5 million kWh and 3,800 tonnes CO$_2$e each year.

This Activity has contributed towards achieving objectives of the “Powering Down” Project by substantially demonstrating improved energy efficiency and reducing electricity use and greenhouse gas emissions to our community. These
reductions are a significant contributor to Council’s energy and emissions reduction targets.

**Lessons Learnt**

Overall, the installation of lights was a success. The key challenges for this large Activity are outlined below:

- The original replacement target in our funding application was 12,700 lights. This was based on the GIS data provided by Powercor and Jemena (DNSPs) at the time of application. During the design and implementation stages, the DNSPs’ GIS data was found to be highly inaccurate. Specifically, installation crews found a number of lights had already been upgraded to more energy efficient light types in the past, were misidentified, or were in fact high-pressure sodium lights where energy efficient replacements were not available. In some cases, the lights simply did not exist in the field. Council used this opportunity to conduct field audits after each stage of installation. There is now has an updated record of the lighting stock, which ensures the savings are accurately reflected in future billing for lighting and maintenance charges.

- The first stage of the changeover with Powercor was also the first project of its scale and type for that particular Powercor office. Powercor also experienced problems with one of their digital systems. This resulted in some delays, including to finalising contracts, producing installation maps and mapping errors.

- Stage One of the Activity commenced prior to LEDs being approved for installation in the Powercor and Jemena distribution areas. Therefore, this stage of Powercor lights, and all Jemena lights are fluorescent T5s. Once LEDs became available for Powercor, the remaining two stages were amended to allow for the use of LEDs lights.

- A small number of the new lights were found to be faulty. These were returned to the manufacturer for replacement.

- There were also a small number of resident calls, concerned about the new lights being too bright and light spilling into their properties. These calls were addressed on a case-by-case basis directly by Council with technical support from Ironbark Sustainability. All were all managed with a positive resolution.

The key to an Activity of this scale and size was to maintain an effective Project Control Group with representatives from the DNSP, Ironbark Sustainability and Council. The PCG resolved all issues and worked together to achieve intended installation outcomes. Effective communication and good working relationships were developed over the four year period and this is evidenced by the successful installation of 11,622 energy efficient lights.
3.1.2. **Sunshine Municipal Office – Heating, Ventilation and Air Conditioning (HVAC) upgrade**

**Our Challenge**

The Sunshine Municipal Office is Council’s largest office building, with over ten Departments working from this location. This office has the highest electricity use and associated greenhouse gas emissions of all Council’s municipal offices.

The existing HVAC plant was over 20 years old and was not designed for functional change of the office space to an open plan fit-out. The Building Maintenance Department received the highest numbers of complaints regarding the HVAC system from this office. Due to a lack of relocation options for staff at the time of this Activity, works would be completed one Department office area at a time, to address the challenge of minimising disruption to staff.

This Activity aimed to improve thermal comfort, whilst also achieving energy and cost savings through the more efficient HVAC systems.

**Our Approach**

A Project Control Group was established to ensure input from key internal stakeholders, including the Building Maintenance Department, Council’s mechanical services contractors, Environment Department and key staff in each Department located at the office. This Activity was resourced sufficiently through this structure, and this consultative approach has been replicated in other Council works.

The HVAC Upgrade Plan prepared by consultants, was reviewed by Council’s new mechanical services contractors and a work schedule was set out to upgrade the building one Department area at a time. Communications with the whole office, and with the relevant Department staff was undertaken to prepare for works and maintained throughout the Activity.

**Works Completed**

The old HVAC units were upgraded to new package units with variable speed drives and outside air intake. A new stand-alone Building Management System (BMS) was installed and connected to all HVAC units.

The HVAC units and BMS were selected in consultation with Building Maintenance staff, and installed by Council’s mechanical services contractors. Installation of the units was completed over a 4 month period, with commissioning finalised for each part of the HVAC upgrade immediately after works in each Department area were finished.
Outcomes and Benefits

This Activity has contributed towards achieving all objectives of the “Powering Down” Project: demonstrating improved energy efficiency in Council’s largest office, reducing electricity use and greenhouse gas emissions that contribute to Council’s energy and emissions reduction targets, improved management of the building through the HVAC BMS controls, and increased occupant thermal comfort with new units.

Energy reduction and management of HVAC plant through the BMS aligns with the funding Objective of demonstrating energy reduction and management practices across a council use building.

Combining the installation of new HVAC plant with the BMS system has enabled greater control of the plant in each Department area as well as thermal comfort. The new plant increased the input of fresh air into the system, providing improved indoor air quality for staff. An office environment with greater thermal comfort and indoor air quality contributes to productivity gains and staff wellbeing.

Energy Efficiency Outcomes

The Sunshine Office’s annual energy consumption after the HVAC upgrade has reduced by an estimated 16,600 MJ, or 0.9% relative to the baseline energy usage. This is equivalent to an annual estimated greenhouse gas emissions reduction of 6.2 t CO₂-e. These figures have been estimated by an external energy auditor as per the funding agreement requirements.

These reductions were lower than anticipated, however they cannot be considered in isolation. The installed units were required to be of a higher capacity than initially planned to ensure ventilation standards were met. The office use also changed after the installation, to include a customer service point with automatic opening doors. These would reduce the HVAC system’s ability to maintain indoor thermal comfort. The smaller than expected energy savings are viewed as a success due to these unanticipated factors.

Lessons Learnt

Installation of HVAC systems into occupied buildings is challenging due to the inevitable impact on staff during installation works. There was limited space for Council staff to relocate to, whilst works were being completed. Building Maintenance had also originally planned refurbishments for each office, scheduled for after the HVAC upgrade.

The Project Control Group decided to combine all works to reduce the disturbance to staff. With several contractors on site at the same time, this resulted in more efficient works schedule as communication was more effective.

A key lesson from this activity has been to engage Council’s mechanical services contractors as early as possible in scoping energy efficiency actions and recommendations. This would ensure that proposed solutions scoped by third parties (e.g. energy auditors) are compliant with Building Code provisions by design, and are appropriate given site constraints and actual building use.
Ongoing communication with staff also helped to address potential disruption issues. Whilst there were concerns raised by staff regarding relocation and impact of the works, having key staff who effectively communicated back information about the progress of works to their Department was invaluable to the success of this Activity. As the first Project Activity to be completed, this approach was replicated in the Keilor Municipal Office and Deer Park Library Activities.

“This HVAC upgrade has significantly reduced complaints about inconsistencies in air conditioning at the Sunshine Office. We now have reliable control of this plant”

Manager, Building Maintenance
3.1.3. Keilor Municipal Offices – Lighting and Insulation Retrofit

Our Challenge

The Keilor Municipal Office is Council’s second-largest municipal office, and also houses a community Customer Service point. The office is second to the Sunshine Municipal Offices for electricity use, and underwent significant heating, ventilation and air conditioning (HVAC) upgrades to reduce inefficient energy use. Ceiling insulation and lighting upgrades under the Project were the next steps in increasing energy efficiency in this building.

The ceiling insulation was very old and spread inconsistently throughout the roof cavity. The original and inefficient T8 (32 Watt) lighting had not been adjusted to suit the office layout, and there were no timers or switching controls.

This Activity aimed to achieve improved energy efficiency of the HVAC plant through installation of insulation, and more appropriate lighting levels and lighting control in this building.

Our Approach

A Project Control Group (PCG) was set up to ensure input from key internal stakeholders, including Building Maintenance, Council electrical contractors, and the Environment Department. Key staff in some Departments were contacted through the Activity where required. This Activity was resourced sufficiently through this structure, and this approach was consistent with other works in Council.

The PCG investigated and opted to install 3.0R polyester batts and T5 (28 Watt) lamps fitted into a newly available sensor-enabled lighting technology. Leading up to the start of this Activity, Council had rolled out LED (21 Watt) upgrade project across several offices. Significant issues arose with staff complaints about reduced light levels in these offices. Council’s electricians confirmed they were not confident in the reliability of LED products available.

In liaison with our funding contact, the PCG group then decided to install T5 (28 Watt) lamps with the Organic Response system. Along with the additional lighting control of this system, Council was confident in achieving energy reduction comparable to LED 21 Watt lamps, whilst maintaining reliable light levels for our staff.

The lighting technology was selected as it utilises a sensor that enables control for each individual light fitting. Rather than setting one light level for the whole building, this system allows for light levels (Lux levels), to be set for individual or grouped lights, adjusted for available daylight and to motion sensing. Each light is set via a smart phone/tablet app paired with a plug-in dongle, enabling Building Maintenance and Council’s electricians to address light issues on an individual and Department level.
**Works Completed**

Council’s electrical contractors installed the insulation at the same time as the light fittings. The majority of works were completed outside weekday office working hours and on the weekends to minimise disruption to staff.

Installation of over 230 lights and insulation for the whole ceiling was completed over a 3 week period. Commissioning of the lights took two days, including setting light levels and responding to staff inquiries for minor adjustments.

**Outcomes and Benefits**

This Activity has contributed to the achievement of all objectives of the “Powering Down” Project: demonstrating improved energy efficiency in Council’s second-largest Office, reducing electricity use and greenhouse gas emissions that contribute to Council’s emissions reduction targets, improved management of the building, and increased occupant comfort through consistent light levels.

The choice of lighting technology that enables greater control of individual light is an excellent example of the funding Objective of addressing and demonstrating energy reduction and management practices across a council and community use building.

Combining the installation of new lights with the Organic Response controls has enabled Council to achieve Lux levels appropriate to specific areas of the office that require more light (e.g. reading plans), or less light (e.g. in a hallway), rather than a single light level setting across the entire building.

Before this Activity was completed, Keilor Office had the highest number of staff inquiries raised over light levels and lights not working. Council’s Building Maintenance Department has reported that since this Activity was completed, no complaints have been received. This is indicative of a better working environment for staff and has reduced reactive maintenance costs for this building.

**Energy Efficiency Outcomes**

The Office’s annual energy consumption after the lighting and insulation installation has reduced by an estimated 125,941 MJ, or 6.1% relative to the baseline energy usage. This is equivalent to an annual estimated saving in greenhouse gas emissions of 54 t CO$_2$-e, or an 10.2% reduction. These figures have been estimated by an external energy auditor as per the funding agreement requirements.

These reductions were lower than anticipated, however they cannot be considered in isolation. Other factors such as variance in the weather, building operation and occupancy all influence the building’s energy consumption. There was a change to the building opening hours and occupancy of visitors, as the location for Council meetings was changed after the initial energy efficiency estimates were completed. These meetings were moved from another location and held at the Keilor Office, contributing to an increased use of lighting and HVAC plant.
Lessons Learnt

Choosing the Organic Response new lighting technology meant that we could not re-use the existing light fittings as the sensor was part of the actual fitting. To overcome this, Council’s electricians had tested a “flange” to retrofit the fitting to the existing space, however this did not fit. The final solution was to have light fittings custom-made, and this added to the timeframe for works. A direct benefit was the resulting consistent and improved aesthetic of the new light fittings across the whole office which had previously contained several different types of light fittings.

Installing lights and insulation out-of-hours was an excellent approach to minimising staff disruption. Key staff in the building were positive and enthusiastic about the new lighting. They provided constructive feedback on light levels and were inspired examples for other staff who wanted to discuss the lighting project in more detail or were unsure about the change to new lights.

Since this Activity was completed, LED technology has improved significantly and a number of models have been recommended by Council’s electricians. Council has now installed LED office lights with success and will be considering further use of LED lights in future lighting upgrade works.

“We no longer receive lighting maintenance requests from the Keilor Office... An excellent outcome for office staff and for our Department”

Coordinator, Building Maintenance
3.1.4. Deer Park Library – Heating, Ventilation and Air Conditioning (HVAC) upgrade

Our Challenge

Deer Park Library’s existing HVAC system was more than 20 years old, and running at full capacity year round. This system was inadequate for the increase in approximately 50,000 library customers over a 10 year period. This significant increase in community use, combined with an additional 30 computers and other educational and administrative technology being installed, resulted in an increased heating and cooling demand that the original two HVAC package units were not able to meet. Library staff received regular customer feedback on the inadequacy of air conditioning and temperature at the Library.

This Activity aimed to improve thermal comfort to community, customers and library staff, whilst also achieving much improved energy performance and cost savings.

Vandalism was considered a risk to the operation of the HVAC units and precautionary measures were taken.

Our Approach

The Building Maintenance Department had planned refurbishments for the kitchen and staff office area. The Project Control Group (PCG) wanted to minimise disturbance to Library customers as the library would need to be closed to complete both upgrades. It was decided to combine all works into the one installation timeframe. With several Council contractors on site at the same time, this option resulted in more efficient works as communication was easier and any possible double-ups in works were avoided.

The PCG worked closely with Library staff to coordinate preparatory works and to ensure communication with customers was clear and to minimise the period of temporary closure to the public. It was also decided to undertake the works before summer so that the units could be commissioned and tested with sufficient time, to be ready for peak demand.

This Activity required coordination across several contractors and was resourced through the Council’s Building Maintenance Department and contractors. This structure and approach has been replicated in other works in Council.

“'The library air conditioning upgrade has provided a much more comfortable and appropriate environment for our community library users”

Services Coordinator, Brimbank Libraries
Works Completed

The two old HVAC units were upgraded to new package units with variable speed drives, outside air intake and after-hours push button controls. Anti-vandal cages were constructed around the units to provide protection against potential vandalism.

The HVAC units and controls were selected and installed by Council’s mechanical services contractors and Building Maintenance staff. Installation of the units was completed alongside other refurbishments during a 2 week period, with commissioning completed in the following week.

Outcomes and Benefits

This Activity has contributed towards achieving all objectives of the “Powering Down” Project: demonstrating improved energy efficiency in a community facility, reducing electricity use and greenhouse gas emissions that contribute to Council’s energy and emissions reduction targets, and increased customer and staff thermal comfort. Energy reduction of HVAC plant aligns with the funding Objective of demonstrating energy reduction practices in a community facility.

The new plant increased the input of fresh air into the system, providing an improved indoor air quality for customers and staff. Greater thermal comfort and indoor air quality contribute to a more enjoyable library experience for all users.

Energy Efficiency Outcomes

The Library’s annual energy consumption after the HVAC upgrade has reduced by an estimated 60,022 MJ, or 14.5% relative to the baseline energy usage. This is equivalent to an annual estimated saving in greenhouse gas emissions of 22 t CO2-e, or a 14.6% reduction. These figures have been estimated by an external energy auditor as per funding agreement requirements.

These reductions were higher than anticipated, however they cannot be considered in isolation. Other factors such as variance in the weather, building operation and occupancy all influence the building’s energy consumption.

Lessons Learnt

Installation of HVAC systems at a customer-focused building such as a library is challenging due to the potential inconvenience of closing or altering community services. This can further impact the ability of staff to manage customer expectations. Combining both HVAC upgrade and building refurbishment works was an excellent approach in minimising customer and staff disturbance. Ongoing communication with the Library Services Coordinator and Team Leader was imperative to ensure all expectations were met. These staff members were then able to effectively communicate progress of works to the Library customers.
3.1.5. **Sunshine Leisure Centre – Cogeneration Installation**

**Our Challenge**

The Sunshine Leisure Centre is Council’s largest energy using facility and Brimbank’s busiest leisure centre with approximately 245,000 visitors annually. The Centre features two 25m indoor pools, spa and steam rooms, gymnasium and group fitness, and crèche facilities. There is also an outdoor pool and splash play area that is open during the warmer months.

Energy reduction measures such as plant and lighting controls, pool temperature and pool covers had either been addressed or could not be implemented due to operational reasons. The installation of a cogeneration plant was then identified through audits and feasibility studies as a priority measure to reduce energy use and greenhouse gas emissions.

As the first cogeneration plant installation at Council, this was a significant undertaking that presented exciting challenges.

This Activity aimed to significantly reduce electricity use and the associated greenhouse gas emissions in this key community facility, whilst also achieving electricity cost savings and demonstrating energy reduction action to our community.

**Our Approach**

A Project Control Group (PCG) comprised of representatives from the Leisure Centre, Urban Design, Building Maintenance, Property Services, Procurement and Environment Departments met regularly to discuss and plan this significant Activity. Led by the Environment Department, this group toured other Councils’ cogeneration projects, identified key concerns and potential issues for each stakeholder, and decided on a plan for procurement of the cogeneration unit.

Several key issues were identified from other Councils’ cogeneration projects. These issues focused on the installation stages where responsibility for resolving problems could not be attributed to a single contractor, given the various discrete components involved in an installation. Other Councils’ also experienced challenges with connecting the unit to the electricity grid, with Network Distribution Service Providers (DNSPs) inexperienced in cogeneration connections. From a stakeholder perspective, it appeared that Leisure Centre staff in some projects were not always included in the installation planning and PCG meetings. This resulted in issues in the management of the cogeneration unit, and unplanned maintenance costs incurred, after installation.

Research on the installation of cogeneration units with other Councils’ showed they had procured a single contractor through a “design and construct” procurement process. Under guidance of the Brimbank City Council Procurement Department representative,
the PCG decided to take a different approach and procure the supply, installation and ongoing maintenance separately. This separation was an effort to demarcate responsibility more clearly and so procure a project and contract manager separately to a design and install contractor.

The key stages for this Activity were:

- Investigate and learn from other Council cogeneration projects, to apply this learning and ensure the PCG (and especially the Leisure Centre as the "Client"), were confident with the process,
- Engage a Consulting Engineer to write the technical/performance specifications and provide client-side advice throughout the entire procurement process,
- Obtain appropriately qualified and experienced potential contractors through an EOI for installation and associated works,
- Engage contractors for Design and Installation, and separately engage the Project and Contract Management of the cogeneration unit,
- Installation and commission of the unit, training and handover to the Leisure Centre, and
- Monitoring unit performance and assessing how the unit runs during and post defects-period.

**Works Completed**

A 65Watt Capstone turbine cogeneration unit was mounted in an existing external wire cage next to the pool plant room. The unit was connected through the wall to the heating hot water loop for the internal pools. A Building Management System was installed and connected to the cogeneration unit.

The planning and procurement stages were spread across a three year period. The unit installation took less than two months, and a regime for the monitoring, maintenance and management of the unit has been established and is an ongoing process.

**Outcomes and Benefits**

This Activity has contributed towards achieving objectives of the "Powering Down” Project by demonstrating improved energy efficiency in a high-use community facility, and reducing electricity use and greenhouse gas emissions that contribute to Council’s energy and emissions reduction targets.

Energy reduction through the installation of the cogeneration unit aligns with the funding Objective of demonstrating energy reduction and management practices across a community use facility.
Energy Efficiency Outcomes

At the time of this report, a full 12 months of post-installation electricity and gas data was not available for analysis. It should be noted that only 8 months of gas and electricity data was available for the energy efficiency estimates completed by the external energy auditor.

In comparison to the 8 months of baseline energy use, an estimated emissions reduction of 414 t CO$_2$-e indicates that the cogeneration unit is on track to meet the anticipated annual reduction of 465 t CO$_2$-e. These figures have been estimated as per the funding agreement requirements.

Council is underway with further electricity and gas data assessments to ensure the operation of the cogeneration unit is optimised to maximum energy, cost and greenhouse gas savings.

“We had no disruption or impact on our pool operation during the cogen installation. The PCG was a good structure to ensure the project ran smoothly.

The best part is our reduced electricity bills –I’m looking forward to a full year of data so we can analyse the full reduction.

It’s also exciting to know that our Centre is now contributing to a reduction in greenhouse gas emissions for our community”

Manager, Sunshine Leisure Centre
Lessons Learnt

Installation of a cogeneration unit was the first project of its kind for Council. The project timeframe was longer than initially planned, however this resulted in a better outcome overall. The additional time was applied to learning from comparable and previously completed local government projects. Sound decisions were made to separately procure contractors for the supply and installation, and for the project and contract management. There were also no issues during installation and commissioning of the Sunshine Leisure Centre cogeneration unit.

Leisure Centre management staff were actively engaged in the installation and commissioning process and are confident and aware in the operation of the unit. Engagement of key stakeholders was very important in the success of this Activity, and the PCG was an effective structure to ensure concerns were addressed and all members agreed on the project plan. Council strongly recommends a similar stakeholder and procurement structure for future projects involving new technologies.

Future projects for energy supply at large community facilities (such as leisure centres) will need to consider the impact of changing gas and electricity markets on return of investment to Council for new plant. The business case for cogeneration is also shifting due to many complex factors, including the reducing costs of photovoltaics and high efficiency boilers and new/alternative technologies coming to the market.
4. Demonstrating and Communicating Energy Efficiency

4.1. Who were our Stakeholders? How did we communicate with them?

The two key stakeholders for the Project were the Brimbank community and Council staff. The following table summarises communication activities undertaken during the Project to target these stakeholders:

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<th>Sunshine Office HVAC Upgrade</th>
<th>Keilor Office Insulation &amp; Lighting Upgrade</th>
<th>Deer Park Library HVAC Upgrade</th>
<th>Sunshine Leisure Centre Cogeneration Installation</th>
<th>Public Street Lighting Energy Efficient Replacement</th>
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<td>N/A</td>
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<td>✔</td>
</tr>
<tr>
<td>Media Release</td>
<td>✔</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>✔</td>
<td>N/A</td>
</tr>
<tr>
<td>Website updates</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Signage during/after works</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>✔</td>
<td>✔</td>
<td>N/A</td>
</tr>
<tr>
<td>Community Newsletter</td>
<td>✔</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>✔</td>
</tr>
<tr>
<td>Local Newspaper Council ad</td>
<td>✔</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>✔</td>
</tr>
<tr>
<td>Customer Service updates</td>
<td>✔</td>
<td>N/A</td>
<td>N/A</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Staff intranet updates</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Staff Internal Newsletter</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Whole of Office emails</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Environment Department internal newsletter</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Council Staff Executive Updates</td>
<td>✔</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Figure -1: Project Communication Activities
In addition to the communication activities outlined above, Council’s Environment Department undertook the following educational and promotional activities during each year of the Project to help support our community to undertake energy efficiency practices at home and at school:

- Energy-focused workshops as part of the annual Brimbank Environmental Events Calendar. There are two workshops held annually, with approx. 40 participants each year,

- Development of a School Sustainability Resource that aligns with the Victorian school curriculum. This resource includes an energy-focused education section with materials aimed at Foundation to Year 2, Years 3-4 and Years 5-6. Materials include: key student learning outcomes, a flow chart showing the process of making electricity, key terms, age appropriate activities, key facts on the topic of energy and links to additional resources and activities. These resources are available in digital and hard copy to all 70 schools in Brimbank and can be replicated by any local government using Creative Commons Attribution – Non Commercial-Share Alike 3.0 Australia License,

- Energy Saver Kits available to borrow from our five public libraries. These kits contain resources such as books, a ‘powermate’ electricity monitor, digital thermometer, stop watch and Lux meter to assist households to become more energy aware. Approximately six loans are recorded each year,

- 1.6 EFT Environmental Education officers available to Brimbank residents to provide education on energy efficiency in the home alongside other sustainability topics, and

- The Brimbank Sustainable Living Expo held each year, with an Environment Department staff providing information on energy efficiency practices. In 2016, this Stall held an energy efficiency theme. This popular Council event attracted over 3,000 people.

4.2. **Was our communication effective?**

Our communication activities aligned with Council’s current methods of communication. Targeting the whole community through website updates, newspaper and newsletter inserts, Project updates were available to all our residents.

Analytics of 2014-2016 website visitor data show the Project information page had 741 page views, with an average 2 mins spent on the page by each view. There were also a total of 6 media alerts and 4 resulting newspaper articles related to the street light installations and the Sunshine Leisure Centre cogeneration installation Activities.

Feedback from the community was mainly regarding the street light changeover project with less than 10 resident queries over the four year period.

There were 8 articles in the staff internal newsletters available to all Council staff.

As there was no baseline data collated before the Project began, we are only able to make calculated assumptions that community and staff awareness of the Project was raised through our communication methods, and was undertaken effectively.

The Project utilised services from local providers in each Activity as Council engaged local contractors, lighting and HVAC equipment manufacturers and consultants.
5. **Budget**

5.1. **Project Budget**

The Project budget is outline below:

<table>
<thead>
<tr>
<th></th>
<th>Funding Agreement Project Budget</th>
<th>Actual Project Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Australian Government Income Received</strong></td>
<td>$3,512,866.00</td>
<td>$3,512,866.00</td>
</tr>
<tr>
<td><strong>Total Council Contribution</strong></td>
<td>$3,512,866.00</td>
<td>$3,518,997.36</td>
</tr>
<tr>
<td><strong>Total Project Budget</strong></td>
<td>$7,025,732.00</td>
<td>$7,031,863.36</td>
</tr>
<tr>
<td><strong>Overspend</strong> (Council expenditure)</td>
<td>-</td>
<td>$6,131.36</td>
</tr>
</tbody>
</table>

The funding Income received for the Project was $3,512,866. Council’s contribution to the Project was $3,518,997.36.

The Project was completed with a minor over-spend of $6,131, that was additional Council expenditure.

Unexpected costs included changing to LED streetlights that were more expensive than the T5 lights originally specified. The installation costs were less than anticipated and so this only left a small surplus. As there were slightly less lights found in the field than anticipated, this surplus was used to install additional decorative lights with no overall budget impact.

Installation of the cogeneration unit required a higher than usual contingency due to anticipated installation challenges, however this contingency was not ultimately needed and there was no impact to the budget.

There were higher-than anticipated in-kind contributions of staff time required to ensure full Project delivery, however this was managed by coordination of staff workloads.

Council is confident this project achieved and will continue to provide value-for-money to our community through the substantial cost savings from energy reduction, most significantly through the street lighting and cogeneration Activities.
6. Conclusion

The ‘Powering Down’ Project, co-funded by the Australian Government, is the single largest undertaking of energy efficiency activities in the history of Brimbank City Council.

Council achieved the key aims of the Project, improving energy efficiency, reducing energy use and greenhouse gas emissions of key Council buildings, facilities and street lights. The Project involved the following five Activities:

- Heating, Ventilation and Air Conditioning (HVAC) upgrade at Sunshine Municipal Office
- Lighting and Insulation Retrofit at Keilor Municipal Office
- HVAC Upgrade at Deer Park Library
- Cogeneration Installation at Sunshine Leisure Centre
- Changeover of over 11,622 Public Street Lights to Energy Efficiency Lights

Across the office and Library upgrades, and the installation of a cogeneration unit at the Sunshine Leisure Centre, Council successfully managed to keep sites operational and minimised disruption to services.

The most ambitious Activity was the public streetlight upgrades across the entire municipality, and after minor GIS issues early on, there were no major problems spanning the entire four-year project period.

Council received $3,512,866 in Round 1 funding and contributed $3,518,997 to this Project (with an additional over-spend of Council expenditure of $6,131). The total Project Expenditure was $7,031,863.

The combined annual greenhouse gas savings are estimated at a total of 4296.2 tonnes CO₂-e annual reduction. This represents a reduction of approximately 13,019,809.7 MJ, and an estimated 16% of Council’s overall operational greenhouse emissions (on 2011 levels). The Project contributes a third of Council’s 50% greenhouse emissions reduction target for the year 2022.

Council benefited in a number of significant ways from undertaking the Powering Down Project over the past few years. Stakeholder relationships have been built and maintained, especially with our Distribution Network Service Providers, Powercor & Jemena. Key communication channels have been redefined within Council, with effective cross-departmental collaboration recognised as a key factor in the successful delivery of this Project. Council also provided project updates and delivered community energy reduction education throughout the funding period.

Demonstrating energy reduction and improving energy management practices across Council buildings, community facilities and public lighting has aligned this Project with the funding Objectives. Significant cost savings are being redirected back into Council’s services and further energy efficiency initiatives.

Council is proud to have worked with our project stakeholders and the Australian Commonwealth Government to complete this Project on time and within budget.
DECLARATION

The Authorised Officer of the organisation makes the following declarations:

✓ I declare that I am authorised to submit this Final Report (including any attachments) on behalf of Brimbank City Council

✓ I declare that the information provided in this Final Report is true and accurate.

✓ I understand, and acknowledge that giving false or misleading information in this Final Report is an offence under the Criminal Code Act 1995.

✓ I understand that final payment will only be made in accordance with the Funding Agreement including on satisfactory completion of Milestones.

Authorised Officer Signature:

Date: 14 June 2016

Name: Neil Whiteside

Signature: 

Position: Director, Infrastructure and Environment

Organisation: Brimbank City Council

Witness Signature: 

Date: 14 June 2016

Name: Helen Christie

Position: Executive Assistant

Organisation: Brimbank City Council

The use and disclosure of information provided in this Final Report is regulated by the relevant provisions and penalties of the Public Service Act 1999, the Privacy Act 1988, the Freedom of Information Act 1982, the Crimes Act 1914 and the general laws of the Commonwealth of Australia.

Information contained in the Final Report may be disclosed by the Department for purposes such as promoting the program and reporting on its operation and policy development. This information may also be used in answering questions in Parliament and its committees. In addition, the selected project information will be made publicly available. Public announcements may include the name of the grant recipient and of any project partners; title and description of the project and its outcomes; and amount of funding awarded.
Contact us

Telephone: 9249 4000
Email: info@brimbank.vic.gov.au
Post: PO Box 70
      SUNSHINE VIC 3020
Website: www.brimbank.vic.gov.au

Hearing or speech impaired? TTY dial 133 677 or Speak & Listen 1300 555 727 or www.iprelay.com.au, then enter 03 9249 4000

Find us on Facebook, Twitter and YouTube

Facebook: www.facebook.com/brimbankcouncil
Twitter: www.twitter.com/brimbankcouncil
You Tube: www.youtube.com/brimbankcitycouncil

Customer Service

Sydenham
Station Street, Taylors Lakes
(located within Sydenham Library)

Opening hours
M: 10.30am - 7pm
Tu: 1:00pm - 7pm
W: 10.30am - 7pm
Th: 10.30am - 7pm
F: 10.00am - 5pm
Sa: 10.00am - 12:30pm

Sunshine
301 Hampshire Road, Sunshine

Opening hours
Monday to Friday
8.45am - 5pm

Keilor
704B Old Calder Highway, Keilor

Opening hours
Monday to Friday
8.45am - 5pm

Municipal Offices

Keilor Offices
704B Old Calder Highway, Keilor

Opening hours
Monday to Friday
8.45am - 5pm

Sunshine Offices
6-18 Alexandra Avenue, Sunshine

Opening hours
Monday to Friday
8.45am - 5pm
### Building 1

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>Sunshine Municipal Office</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>6 – 18 Alexandra Avenue, Sunshine, Vic 3020</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Council office administration building</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Upgrade of HVAC system</td>
</tr>
<tr>
<td>Baseline Energy Usage</td>
<td>1,921,018 MJ per annum (533,616 kWh x 3.6 MJ)</td>
</tr>
<tr>
<td>Baseline Energy Efficiency</td>
<td>Pre implementation: 733 MJ per m² per annum (1,921,020 MJ / 2,621 m²)</td>
</tr>
</tbody>
</table>
| **Energy Efficiency Improvement** | Estimated reduction 227 MJ/m² (=165,000kWh x3.6 MJ / 2,621 m²) Estimated emissions reduction: 84.31 kg CO₂-e/m² (=221 tonnes CO₂-e / 2,621 m²)  
Note: The sites annual energy consumption post-implementation of energy efficiency measures has reduced 0.9% relative to the baseline energy usage. This is equivalent to 16,600 MJ of energy or 6.3 MJ/m². Associated emissions have reduced proportionally, equivalent to 6.2 tonnes CO₂-e or 2.4 kg CO₂/m². While these reductions are well below the original estimates, it does not conclude an energy efficiency improvement has not been achieved. This is because other factors such as variance in the weather, building operation and occupancy all influence the sites energy consumption. 
Council comment: These reductions were lower than anticipated, however they cannot be considered in isolation. Due to errors in the initial consultant’s report, the installed units were required to be of a higher capacity than initially planned, to ensure ventilation standards were met. The office use also changed after the installation, to include a customer service point with automatic opening doors. These would reduce the HVAC system’s ability to maintain indoor thermal comfort. The smaller than expected energy savings are viewed as a success due to these unanticipated factors. |
| Reporting Data (Measuring Energy) | Floor area of 2,621 m² 
150.7 Full Time Equivalent employees |
| Efficiency and Additional Data | 92.8% occupancy  
Daily hours of operation: 7am to 5pm Mon-Fri, 50 hrs/week  
Building construction date 1963, 1981  
Baseline energy:  
- Electricity: 533,616 kWh  
  (July 2012 until June 2013)  
- Natural gas: N/A  
Post implementation energy:  
- Electricity: 529,005 kWh  
  July 2013 until June 2014  
- Natural gas: N/A |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Activity</td>
<td>$950,000 (Funding agreement project budget)</td>
</tr>
<tr>
<td>Estimated Cost Savings</td>
<td>$14,500 per annum</td>
</tr>
<tr>
<td>Building 2</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Name of Building</strong></td>
<td>Keilor Municipal Offices</td>
</tr>
<tr>
<td><strong>Location (address)</strong></td>
<td>704B Old Calder Hwy, Keilor, Vic 3036</td>
</tr>
<tr>
<td><strong>Type of building, facility or site</strong></td>
<td>Council office administration building</td>
</tr>
<tr>
<td><strong>Activity Type and Measure</strong></td>
<td>Upgrade of lights and ceiling insulation</td>
</tr>
<tr>
<td><strong>Energy Efficiency Estimate Method</strong></td>
<td>Conducted in accordance with AS/NZS 3598 – Energy Audits.</td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Usage</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline Energy Efficiency</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Energy Efficiency Improvement</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Note:</strong></td>
<td></td>
</tr>
</tbody>
</table>

Council comment: There was a change to the building opening hours and occupancy of visitors, as the location for Council meetings was changed after the initial energy efficiency estimates were completed. These meetings were moved from another location and held at the Keilor Office, contributing to an increased use of lighting and HVAC plant.

**Reporting Data (Measuring Energy Efficiency and Additional Data)**

- Floor area of 1,843 m²
- 111.1 Full Time Equivalent employees
- 75.6% occupancy
- Daily hours of operation: 7am to 5pm Mon-Fri, 50 hrs/week
- Building construction date 1957.
<table>
<thead>
<tr>
<th>Cost of Activity</th>
<th>$138,752 (Funding agreement project budget)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost Savings</td>
<td>$7,942 per annum</td>
</tr>
</tbody>
</table>

Baseline energy:
- Electricity: 370,856 kWh  
  (June 2012 until May 2013)
- Natural gas: 713,511 MJ  
  (June 2012 until May 2013)

Post Implementation energy:
- Electricity: 329,487 kWh  
  (July 2014 until June 2015)
- Natural gas: 736,498 MJ  
  (June 2014 until May 2015)
### Building 1

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>Deer Park Library</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>Station Road, Deer Park, 3023 Victoria.</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Buildings with standard hours</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Main Library space, upgrade of HVAC: replacement of rooftop package units</td>
</tr>
</tbody>
</table>

#### Energy Efficiency Estimate Method

Estimate based on available interval energy data, advised usage patterns for lighting and general power, overnight use from interval data, HVAC times from service provider and interval data. They are accurate to a Level 2 Energy Audit as prescribed by Australian Standard (AS/NZS 3598:2000).

#### Baseline Energy Usage

Pre implementation:
- Electricity: $111,156 \text{ kWh} \times 3.6 = 400,162 \text{ MJ}$
- Gas: $15,065 \text{ MJ}$
- Total: $415,227 \text{ MJ per annum}$

#### Baseline Energy Efficiency

369 MJ per m² per annum (pre implementation)

#### Energy Efficiency Improvement

- Estimated energy reduction: $36 \text{ MJ/m}^2$ ($11,200 \text{ kWh} \times 3.6 \text{ MJ} / 1,124 \text{ m}^2$)
- Estimated emissions reduction: $13.35 \text{ kg CO}_2\text{-e/m}^2$ ($15 \text{ tonnes CO}_2\text{-e} / 1,124 \text{ m}^2$)

Note: The sites annual energy consumption post-implementation of energy efficiency measures has reduced 14.5% relative to the baseline energy usage. This is equivalent to $60,022 \text{ MJ}$ of energy or $53.4 \text{ MJ/m}^2$. Associated emissions have reduced 14.6%, equivalent to $22 \text{ tonnes CO}_2\text{-e}$ or $19.6 \text{ kg CO}_2\text{-e/m}^2$. While these reductions are higher than the original estimates, the figures cannot be considered in isolation. Other factors such as variance in the weather, building operation and occupancy all influence the sites energy consumption.

#### Reporting Data (Measuring Energy Efficiency and Additional Data)

- Floor area of 1,124 m²
- 11.67 full-time equivalent employees
- Visitation: 250,407 (FY2013/14)
- Hours of operation: 6 days a week - 56.5 hrs/week
- 9am to 8pm Mon, Wed, Thu, noon to 8pm Tue, 9am to 5pm Fri and Sat, closed Sun
- Building construction date: 1992

Baseline energy:
- Electricity: $111,156 \text{ kWh}$ (1/10/2012 to 30/09/2013)
- Natural gas: $15,065 \text{ MJ}$
Post-implementation energy:
- Electricity: 94,839 kWh
  (1/10/2014 to 30/09/2015)
- Natural gas: 13,784 MJ
  (7/10/2014 to 6/10/2015)

<table>
<thead>
<tr>
<th>Cost of Activity</th>
<th>$99,480 (Funding agreement project budget)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost Savings</td>
<td>$3,200 per annum</td>
</tr>
</tbody>
</table>
**Building 1**

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>Sunshine Leisure Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>1 Kennedy Street Sunshine, 3020 Victoria.</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Leisure Centre</td>
</tr>
<tr>
<td>Activity Type and Measure</td>
<td>Cogeneration unit installed</td>
</tr>
</tbody>
</table>

**Energy Efficiency Estimate Method**

Estimate based on professional consultant’s engineering feasibility study. The study was completed by BRT Consulting.

**Baseline Energy Usage**

- **Electricity**: $1,202,813 \text{kWh} \times 3.6 = 4,330,127 \text{MJ}$
- **Gas**: $14,528,890 \text{MJ}$
- **Total**: $18,859,017 \text{MJ}$

**Baseline Energy Efficiency**

Pre implementation:
- $17,462 \text{MJ per m}^3 \text{heated water per annum}$

**Energy Efficiency Improvement**

Estimated net reduction 465 t $\text{CO}_2$ per annum

($= 0.431 \text{ tonnes C0}_2/\text{m}^3 \text{ heated water per annum}$)

**Notes:**
- Sub-metered electricity and heat generation for the period 1/06/2015 to 20/04/2016 (325 days) was 417,598 kWh
- Sub-metered thermal energy off the cogeneration plant was equivalent to 656,768 kWh (same period above)
- Post implementation utility consumption available (8 months), extrapolated over 12 months, yields an electricity reduction of 441,755 kWh and a gas increase of 3,470,015 MJ, with net emissions reduced by 414 tonnes.

Council note: With a very simple calculation of t $\text{CO}_2$-e converted to MJ, the estimated annual net reduction of 465 t $\text{CO}_2$-e is equivalent to 1,481,416 MJ. It important to note that actual data for the full 12 month period has not yet been collected.

**Reporting Data (Measuring Energy Efficiency and Additional Data)**

- Total volume of pool water heated per annum (indoor and outdoor normalised*): $1,080 \text{ m}^3$
  - Indoor pools are heated for 12 months per annum
  - The outdoor pool is heated from start of November to end of March (5 months). The total volume of pool water heated in the outdoor pool has been scaled down in proportion with the number of months the outdoor pool is heated per annum.
  - Floor area of $1,535 \text{ m}^2$
  - 34.65 full-time equivalent employees
  - Annual visitation: 245,010
| Hours of operation: 7 days a week - 97 hrs/week  
| 6am to 10pm Mon to Thu, 6am to 9 pm Fri and 9am to 5pm Sat and Sun  
| Baseline energy:  
| - Electricity: 1,202,813 kWh  
| 1/06/2014 to 31/05/2015 (12 months)  
| - Natural gas: 14,528,890 MJ  
| 1/06/2014 to 31/05/2015 (12 months)  
| Post implementation:  
| - Electricity: 507,372 kWh  
| [1/06/2014 to 29/02/2015 (8 months)]  
| [=761,058 kWh extrapolated over 12 months]  
| - Natural gas: 11,999,000 MJ  
| [1/06/2014 to 29/02/2015 (8 months)]  
| [=17,998,905 MJ extrapolated over 12 months]  
| Cost of Activity | $485,000 ex GST (Funding agreement project budget)  
| Estimated Cost Savings | $60,000 per annum |